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4 SEPTEMBER 1986

# USSR Report

CYBERNETICS, COMPUTERS AND  
AUTOMATION TECHNOLOGY

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4 SEPTEMBER 1986

USSR REPORT  
CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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EVALUATION OF PRODUCTIVITY OF MULTIPROCESSOR COMPUTER SYSTEM TAKING INTO ACCOUNT CHARACTERISTICS OF SUBSCRIBER TASKS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 5, Sep-Oct 85  
(manuscript received 4 May 85) pp 3-8

[Article by A.V. Maksimenkov and G.A. Meshcheryakov]

[Abstract] High-productivity modular systems are now being used for a broad range of functions with a central unit consisting of several linked processors with a common memory. In order to attain high productivity each processor has its own scratch-pad memory with relatively small capacity which are made time compatible with the main memory by means of partitioning of the main memory and interleaving of addresses within the partition and group exchange of data between the common and scratch-pad memories. This structure makes it possible to reduce the exchange times for several word groups between the main and individual memories to a period equal to the time necessary for extracting one word from the main memory. Productivity of the system is determined by the aggregate response times of the central processors but the methods now used for productivity evaluation do not sufficiently take into account the structural features of the system design and especially the subscriber task characteristics upon which productivity essentially depends. The difference between rated and actual performance can be 50 percent or more. A procedure is given for estimating productivity for an El'brus modular multiprocessor system or for YeS system computers. A pipeline processing model is developed for system productivity consisting of the average number of operations in a unit of time. Losses are considered to be due to queuing by several processors for the same memory sections, queuing for operating system tables and programs, time expenditure for processing of operating system programs and waits because no tasks are available for processing. Processor response speeds can then be evaluated by inserting loss coefficients into the processing model. The processor cycle is determined by the period necessary for access to the scratch-pad memory and processor effectiveness is largely determined by the response speed of the scratch-pad memory. The procedure was used to evaluate productivity of an El'brus-2 complex by means of an algorithm in PL/I realized on a YeS 1033 computer, which requires 1.5 minutes of machine time and 60K bytes of memory to run. Using parameters 10 processors, 0.05 microsec. clock speed per

processor, 0.6 microsec. time for main memory access, and others, the effective speed of an El'brus-2 processor was calculated as 13.83 MOPs, where 85% of the processor power is said to be used. Taking into account various losses, the overall speed of an El'brus-2 is said to be 80.34 MIPS.

12497/9835  
CSO: 1863/64

UDC 681.324

#### SCHEDULING OF COMPUTER OPERATIONS TAKING INTO ACCOUNT EXCHANGE TIME IN MICROPROCESSOR SYSTEMS

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 6, Nov-Dec 85  
(manuscript received 29 Dec 84) pp 85-89

[Article by V.V. Suskin]

[Abstract] A model is presented for the description of parallel functioning in microprocessor systems. The formalization consists of a set of operators carrying out certain operations and a number of information links connecting operators for the transmission of operands. Each operator has a time characteristic. Scheduling in the system reduces to partitioning the operators according to an optimization criterium consisting of the minimal time of task execution. However the usual methods do not take into account the information exchange times between operators distributed in different microprocessors which can lead to a deviation from the optimum. A minimum time method using a graph model is presented taking into account exchange times and a heuristic algorithm is given based on direct links between operators and assumptions as to the selection of microprocessors for operator distribution. The algorithm was found to attain computed optimums with a deviation of less than 1.7 percent. References: 6 Russian.

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CSO: 1863/138

UDC 681.325

#### SEVERAL METHODS FOR ORGANIZING NONAUTONOMOUS COMPUTATION IN MULTIPROCESSOR SYSTEMS WITH PROGRAMMED ARCHITECTURE

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 5, Sep-Oct 85  
(manuscript received 18 Feb 85) pp 16-19

[Article by A.V. Kalyayev and I.I. Itenberg]

[Abstract] In multiprocessor systems it is necessary to minimize input/output times for individual tasks while dealing with a broad range of tasks and the

system must be able to maximize parallel processing capacity, adjust architecture to task needs and combine data transmission and processing operations at the same time. Programmed architecture systems involve nonautonomous computation with digit-by-digit processing. The system has a decision field consisting of several microprocessors with programmed structures allowing multiple combinations, distributed memory facilities and buffer memories. There must be complete intrasystem linkage which will be relatively simple because of nonautonomous operation allowing uninterrupted conveyor-type processing. It is a necessary condition that conveyor processing be continuous. Two possible approaches to the organization of nonautonomous computation are considered involving synchronous or asynchronous operation. It is shown that asynchronous operation does not completely limit operational breaks and so the nonautonomous system must be synchronous for uninterrupted conveyor processing. A synchronous system involves either additional switching elements in the microprocessor decision field or programmed timing of microprocessor output and the latter is preferred as more flexible and universal. Computations are given showing that there is a marked improvement in response speed when the synchronous method is used. Figures 2; references: 3 Russian.

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UDC 681.335

#### AMPLIFIER WITH CHARGE ACCUMULATION

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 5, Sep-Oct 85  
(manuscript received after revision 23 May 85) pp 28-31

[Article by A.D. Bekh]

[Abstract] In order to reduce parasitic capacitance so as to increase response speed of the collector junction of transistor amplifiers at high frequencies, the resistance of the collector junction is reduced but this increases the dissipated power. The conflict between response speed and power loss hampers the introduction of microprocessor technology into control systems because the filtering and digital transforms of wideband signals entering the computer through primary converters present problems. Microelectronic designs are especially complex for the voice range and there are no available solutions for higher frequency ranges. The most effective solutions are active filters built from operations amplifiers and microprocessor digital filters. The frequency ranges for real time operation are approximately the same in both cases but the digital filter range is limited by the coding procedures. The frequency range of active filters can be broadened by using a bipolar transistor with output voltage equal to the scalar product of the time relations of the base voltage and the emitter current. The frequency range of the input signals is limited only by the emitter current frequency. In this type of transistor the collector

resistance mode is replaced by charge accumulation by a capacitor connected to the collector. The transistor can be used for the design of high-frequency currents. Figures 3; references: 4 Russian.

12497/9835  
CSO: 1863/64

UDC 681.142

# FORMULATION OF STIMULATION SEQUENCES FOR SIGNATURE ANALYSIS TESTING OF MICROPROCESSOR UNITS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 5, Sep-Oct 85  
(manuscript received 7 Dec 84) pp 43-47

[Article by V.A. Gulyayev and V.I. Kudryashov]

[Abstract] Diagnostic procedures for testing microprocessor equipment are considered involving the writing of signature analysis test sequences (TPSA). The literature is reviewed and it is found that TPSA for specific equipment are given rather than procedures for forming the sequences. The TPSA formulation problem is more complex for LSI equipment diagnosis and a microprocessor unit will require a different test sequence for each of its component parts. The problem is made more difficult by the fact that pseudorandom number generators cannot be used for stimulation of microprocessors which have certain forbidden states and thus programmed stimulation is necessary. The results of the test sequences are then subjected to signature analysis. A formalized method is considered for generating TPSA for full sets of commands (read, write, etc.) or for subsets. The method does not require the topology of the circuits be known because the chip layout is usually not available to the user. A square matrix is formed from the system of microprocessor commands and a method is given for writing out all the commands on the TPSA. Various tests for main memories which are the most complex parts of the processors are discussed. Stimulation of the Soviet K565 RUZA memory is considered and the algorithm flow sheet is given. Figures 3; references: 9 Russian, 12 Western.

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CSO: 1863/64

SOFTWARE

UDC 681.322.01

OPTIMIZATION OF RESTORATION OF DATA BASES DURING EXECUTION OF INFORMATION-RELATED TASKS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 5, Sep-Oct 85  
(manuscript received after revision 20 Feb 85) pp 79-83

[Article by D.I. Batishchev and A.G. Kosterin]

[Abstract] Failures in computer systems lead to damage to data base integrity. Systems such as OKA, BANK and SIOD have facilities for data restoration in control system data bases. In data restoration procedures there must be optimization of the combination of data processing and data integrity restoration operations. A formal model is described for the problem of operations in the presence of integrity failures. An algorithm is given for data base restoration using dynamic programming for scheduling task processing and data base file copying which minimizes task completion times during data base restoration. It has a first stage consisting of tree search procedures and a second stage which computes the optimal route by a minimum sum method. An equivalent transform graph algorithm which represents computer functioning together with restoration is used to determine expectation values for system operations under the specified conditions. The method programmed in FORTRAN-IV was realized on a SM-4 minicomputer for a data base system functioning on a YeS 1022 computer on a twenty-four hour basis. Comparison of an experimental statistical study on the real system with a test of the programmed algorithm showed that the relative error did not exceed 9 percent. If special facilities are used in the data restoration operations it is possible to incorporate these factors into the model parameters for automated functioning. Figures 2; references: 11 Russian.

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CSO: 1863/64

## STATIC AND DYNAMIC DISTRIBUTION OF PROGRAM COMPONENTS IN AUTOMATED SYSTEMS

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 6, Nov-Dec 85  
(manuscript received 5 Jun 84) pp 54-59

[Article by V.A. Vishnyakov and O.V. German]

[Abstract] The theory of dispatcher functions for computer systems used in CAD and automated control systems is considered. Dispatcher quality is determined by the information available on the operations and system states and resources (memory, links, peripherals, etc.) but sometimes available information is incomplete or insufficient and it is therefore necessary to design dispatchers for less favorable conditions. Formalized dispatcher models and realizations are considered according to criteria of degree of connectedness of operations, required memory and time evaluations for work distribution. Models are considered for the solution of static and dynamic dispatching problems. On the basis of the formalizations, a planning subsystem configuration is designed which can be fitted to the architecture and algorithms of particular computer systems by adding or eliminating elements. The method can be used for multiaccess and multiprocessor systems using microcomputers and also for multicomputer systems. Figures 3; references: 12 Russian.

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CSO: 1863/138

## DIALOGUE INFORMATION-REFERENCE SYSTEM WORKING WITH USER IN NATURAL LANGUAGE

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 5, Sep-Oct 85  
(manuscript received 2 Mar 84) pp 84-87

[Article by N.Yu. Kovalkova]

[Abstract] Dialogue information-reference systems (DISS) in automated control systems are considered which allow natural language dialogue, recognition of the meaning of input statements and generation of statements or data tables on subjects related to the limited range of activity of the control systems. Data in DISS are represented in K-standard language based on the assumption that within the range of the subject matter all concepts are unambiguous and can be assigned to specific categories to which specific semantic and statistical rules apply. The limited possible number of questions and reference words entered in Russian are entered into the linguistic processor where in the semantic interpreter block the statement, in a modified form, is matched to the syntactic model and word lists of the system. Unknown words are ignored. The output goes to the syntactic-analytic



converter block which codes the question for comparison with system states. It detects impossible questions and returns an error response to the user. The DISS then has a conclusion block which gives commands for finding the required file and formulates results. A dialogue generator or data table generator then transmit the conclusions according to standard statement formulations. Answers can be in abbreviated form or in longer grammatically more complete versions. The dialogue generator contains a grammatical editor for synthesizing grammatically correct sentences in addition to the fixed standard responses. Figures 1; references: 2 Russian.

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CSO: 1863/64

UDC 681.3.068

#### AUTOMATED SYSTEM FOR PREPARING TEXT DOCUMENTS BY COMPUTERIZED METHOD

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 5, Sep-Oct 85  
(manuscript received after revision 12 Feb 85) pp 116-118

[Article by A.S. Beketov and V.M. Smolkin]

[Abstract] A dialogue mode multifunction automated text preparation and print-out system of the word processor type is described for SM computers using the ASPO operating system on the SM-2 or SM-1210. This is a hierarchical modular system which is controlled by dialogue interaction in natural language from the display terminal keyboard. Documents can be edited, formatted and previously edited documents can be recalled by introducing instructions. There are seven subsystems: file control subsystem; editing subsystem which is the basic unit; documentation subsystem for preparing and formatting text; print-out subsystem using the SM-6403 printer; computer processing subsystem which can carry out elementary computations; macro control subsystem which allows access to a built-in macroprocessor so that the user can enlarge the input language of the system by means of macro instructions for additional flexibility and help subsystem which gives brief instructions on system operation when required. The system is comparable to the TEKST application pack for the SM-1800 but is more widely applicable. References: 4 Russian.

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CSO: 1863/64

## AUTONOMOUS TRANSLATION OF PROCEDURES

Moscow PROGRAMMIROVANIYE in Russian No 6, Nov-Dec 85  
(manuscript received 26 Nov 84) pp 39-43

[Article by V.P. Pykhalov]

[Abstract] Translation of procedures forming part of other procedures involves problems as to the identification of names. This has hampered the development of modular translation systems for operator-machine interaction. At the present time, when the translation of individual procedures is required, the necessary information exchanges between procedures are usually carried out by means of parameters or additional constructions are added to the language as in Fortran common language. The idea was recently developed of storing procedure contexts for use in autonomous translation of procedures, and problems in its realization are considered as concerns the determination of the order of translation, retranslation of nested procedures, name identification, use of contexts for the generation of the object code and interfacing of the operator with the programming system. The problems are discussed for an application on a translator in Instr language which resembles the Pascal and Ada languages. The translator is linked to the IKS programming system on a YeS computer which creates programming using the vertical slicing technique. References: 4 Russian, 2 Western.

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DSO: 1863/139

## APPROACH TO CREATION OF MOBILE PROGRAMMING FOR YeS OPERATING SYSTEM

Moscow PROGRAMMIROVANIYE in Russian No 6, Nov-Dec 85  
(manuscript received 17 Jul 84) pp 44-49

[Article by V.B. Dralyuk]

[Abstract] The adaptation is considered of the YeS computer operating system for various application program packages whose interfacing to the system is becoming more complex especially as concerns interactive programming systems and data base management systems. Static modifications in the control blocks and in the program modules are not adequate because most information is incorporated in operating system algorithms. A general description is given of a method of dynamic prefixing for addressing the various operating system modules in virtual (SVS) mode. It is thus possible to connect to sections of the operating system kernel different types of functional, debugging, service and data base control and protection routines. The approach was used at the Sverdlovsk State College of

Education for creating the Most program package for simulation of program operating mediums to be used for complex system interfacing for communication between computer centers and the Argus program package for an interactive multiple access system. References: 4 Russian.

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CSO: 1863/139

UDC 681.142

#### SIRIUS DATA BASE MANAGEMENT SYSTEM ORIENTED TOWARDS BROAD RANGE OF USERS

Moscow PROGRAMMIROVANIYE in Russian No 6, Nov-Dec 85  
(manuscript received 1 Jul 85) pp 50-57

[Article by G.D. Frolov, Ye.P. Kurshev, L.A. Lyubushkina, N.V. Somin and I.Ya. Freydlin]

[Abstract] The SIRIUS system for the development of large-scale program complexes with data bases for engineering and control systems is described. Introduced in 1978 and now used in 70 or more organizations, it was conceived as a data base management system (DBMS) but has added additional functions extending beyond the DBMS structure. SIRIUS consists of a set of application packages used with the YeS operating system and creates DBMS for control systems, computer-aided design and information retrieval systems and is intended to be simple enough to be accessible to a broad range of programmers with relatively limited qualifications and to be realized on medium class computer equipment (main storage of 512 Kbyte, YeS-1022 computers). The relative universality of the system makes it usable in various fields. The basic language is PL/1 out of which a more general language (SIRIUS-PL/1) was created for extending the data definition language functions. A user knowing PL/1 can in a short time master the enlarged language. The architecture involves the system kernel consisting of programs for data base structures, language and management; the application programs for scheduling, data base input using a high-level language, data base output and other accessing and service functions and an external level for developing programming for problem solution with a set of commands and a metalanguage. References: 6 Russian.

12497/9835  
CSO: 1863/139

## NOTEBOOK-TYPE DATA BASE AND ITS WORKING FACILITIES

Moscow PROGRAMMIROVANIYE in Russian No 6, Nov-Dec 85  
(manuscript received 28 May 84) pp 58-63

[Article by A.V. Pershin, V.I. Shishlov and V.M. Yurkov]

[Abstract] The notebook-type data base and its management facilities: the Dialogue System for Documentation-Oriented Development Control (DISVEDOR) are described. These were developed at the Kiev Executive Committee Municipal System Technology Scientific-Production Association for the design of territorial control and urban management systems. Since the user material is documentation in the form of numerated pages a notebook-type format was used for the data base and the information unit is a page equal to the contents of the videoterminal frame (12 lines with 80 symbols for the YeS-7066 display). The pages are stored in sequential data sets and the user without specialized computer skills can easily consult the stored material as if they were notebook pages. The system executes the design modification method consisting of changes introduced into stored models by the user in dialogue interaction from the terminal. There is menu-type access to four types of notebooks: general pages for prototypes, variants and other documentation, personal pages for individual operators' work, references pages and scenario pages for user planning of work. A tree-type memory format used for the personal pages was previously realized in the DEKOM system. DISVEDOR uses PL/1 language except for one module in assembler language. The system is realized on a YeS computer with the 4.1 version or more powerful operating system, YeS-7066 or YeS-7927-01 displays and 120 K of memory. Figures 4; references: 7 Russian.

12497/9835  
CSO: 1863/139

## APPLICATIONS

UDC 621:65:011.56:65

### ORGANIZATION OF AN INTERACTIVE PRODUCTION CONTROL SYSTEM FOR A MACHINE BUILDING ENTERPRISE

Moscow MEKHAIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 1, Jan 86 pp 29-31

[Article by V. M. Ubeyko]

[Text] The experience from the operation of ASU (automated control systems) reveals that an orientation toward predominant solving of complicated computational problems is not always an effective way to upgrade the control. This is due to the fact that the speed of decision-making in these cases does not match the current pace of production. The director should receive constant and timely information and make decisions on this basis. Considerable help in this area is offered by the use of interactive data processing and transmission.

The organization of interactive processes in control has the following indisputable advantages: the manager is brought closer to the process of machine design and data processing; the work is organized in a real time frame; the interchange of information at the various levels of management takes place without documents; design chores in the area of data processing are automated.

These advantages have been realized in a design of an interactive operation management system for the executive level at one of the machine building enterprises with an experimental production profile.

A remote data processing network is organized in the system, including the information computer center (IVTs) of the enterprise as the chief link. The IVTs is linked to three kinds of terminal, organized for the managers of the services and the factory management departments.

The type of terminal is dictated by its function, the operations it performs and the available equipment (cf. table).

The first kind of terminal is designed to handle information retrieval tasks in the individual work of the computer director and during conferences. This type of terminal is directly linked to the IVTs and is configured with displays, printers, and intercom facilities with the IVTs and other terminals.

Вид оборудования (a)	(b) Вид ТП		
	1	2	3
(c) Дисплей Устройства ввода (d)	ЕС-7927	ЕС-7927 ЕС-6012, ЕС-6013	ЕС-7927 (i) ЕС-6012 ЕС-6013
(e) Печатающие устройства	ЕС-7034.	ЕС-7034.	ЕС-7034
(f) Накопители данных	ЕС-7036	ЕС-7036 ЕС-5017, ЕС-5066, ЕС-9004	ЕС-7036 ЕС-5017 ЕС-5066 ЕС-9004
(g) ЭВМ	(j)	«Искра-226».	СМ-4,5
(h) Переговорное устройство	(k)	«Электроника-100»	ЕС-1022
	(l)	Телефонная сеть	ЕС-1033

Key:

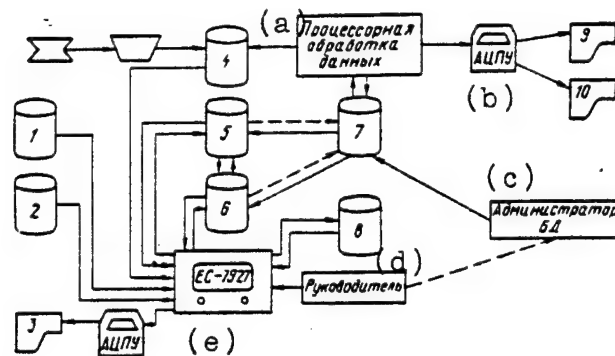
- |                       |                      |
|-----------------------|----------------------|
| a. Type of equipment  | g. Computers         |
| b. Type of terminal   | h. Intercom          |
| c. Display            | i. YeS models        |
| d. Input devices      | j. Iskra-226         |
| e. Printers           | k. Elektronika-100   |
| f. Data storage media | l. Telephone network |
|                       | m. SM-4,5            |

The second kind of terminal, in addition, is used for operational solving of problems during the formulation and analysis of production plans in interactive mode. The terminals are outfitted with displays, printers, local data processing equipment (computers of the type Elektronika, Iskra-226, etc.), equipment for data input/output via communication links to the IVTs, disk and tape storages, intercom facilities to the IVTs and other terminals.

The third kind of terminal is designed to handle control problems in the production shop, to maintain the data bases of the workshops in serviceable condition, and to provide the necessary data to the IVTs. In addition to the above equipment, the terminals are equipped with a computer of sufficient power to solve shop-level problems.

Distributed data bases are organized at the IVTs and in the workshops, between which there are links in all directions: to the IVTs and back, to all the workshops (related industries) and back. Such organization suits the technological specialization of the workshops and enables a no-document interchange of information during the flow of the work objects, finished products and component parts from the storages and from one shop to another. On the other hand, organization of the data bases in the shops lightens the load on the data base at the IVTs, simplifies the latter and improves the efficiency of working with it.

The following logical organization of the data bases at the IVTs is provided (cf. figure). The central data base (index) is integrated, redundant-free and the sole source of data for solving the problems in the computer. This data base is maintained in accordance with the established procedure. Access to it is possible only by direction of the administrator.



Logical organization of data bases: 1 - manual; 2 - dictionary; 3 - videogram copy; 4 - document data base (BD); 5 - format P BD; 6 - format D BD; 7 - index BD; 8 - individual BD; 9 - reports; 10 - system log.

Key:

- |                                     |             |
|-------------------------------------|-------------|
| a. Processor-based data processing  | d. Director |
| b. ATsPU (analog/digital converter) | e. YeS-7927 |
| c. BD administrator                 |             |

The document data base contains copies of all the documents used in the interactions. The data of this base is not accessible to changes or corrections, due to the fact that the actual documents corresponding to the electronic copies are located in the factory, and the introduction of changes into the data base should be instantly accompanied by introduction of changes in the documents themselves. Since this process is protracted over time and space, inconsistencies and contradictory data are possible. Data is sent to the base from two sources: the computer memory as copies printed out by the A/N printer, and copies of documents produced by the computer. The document data base is an electronic archive and the principal data source for the interactions. Since no changes can be made in the data, interaction with this base can only be passive: question-answer.

The format-P and format-D data bases contain data in documents, i.e., they are not integrated. They are intended for active use of documents by the director, who may read them, make changes or additions, and so forth. These data bases are not kept up: they are filled only by request of the director and only with the data of required documents. After the work with the documents is finished, instructions are issued to the administrator to enter them into the document and index data bases, or to destroy them. The data sources are the document and index bases. The presence of two bases of seemingly identical purpose stems from the desire to shorten the reaction time of the system during the interaction. Moreover, such organization of the bases is

the foundation of the computer-aided design system for data processing, and the designers may work out techniques of producing the required results (documents) in interactive mode.

The system provides for the organization of individual bases for the managers, where they may store their required information of document or nondocument form.

An efficient interactive work process of the manager is assured by the presence of the special dictionary and manual data bases, which contain the rules of using the system (easily read off the display screen), as well as a thesaurus of indexes used in the management process.

The INES information economics system is used to create the data bases, maintain them in working condition and carry out the interaction. The data bases have different structures and organization of their management processes. The document data base has a file card organization, in which several components may be identified: headlines of the documents, their permanent items, and the endings of the documents; copies of the documents, a catalogue of headlines and a catalogue of documents. Such organization entails the following techniques of document input from machine carriers: primary organization (input of a document sample, its headline, etc.), input of data; formulation of the document in accordance with the sample. All this takes a single input of all permanent items and reduces the volume of work in the preparation of the data. The data are entered either on punched cards or magnetic tapes in the UPD (data transmission devices) of the YeS-9002, YeS-9003, YeS-9004. The preference should be given to data preparation on magnetic tape, as this greatly reduces the difficulty and the work involved. The system allows for direct data input from display console. This is the most effective process, although its use is limited by the shortage of consoles. At the workshop level, it is anticipated to employ the hardware of the Unified Remote Processing System (YeSTEL-4), including the YeS-9003 data preparation complex, furnished with 16 consoles. This will allow an efficient input of data to the base in a real time frame.

The format-P data base has a treelike structure, with the indexes constituting the document located at the vertices. The structure of the data base reflects the hierarchy of the document indexes, each branch of the tree corresponding to a specific document.

The format-D data base also has a treelike structure, with files corresponding to the document copies located at the vertices.

Input of data to the format bases is done by means of the INES sample input system. The work of the manager with the document base behind the display console may be illustrated by the example of the document "Calculation of Equipment Workload." The documents are kept in the base in the form of a linear file, or set of data. The length of the record corresponding to a single line of the document is within limits of 240 bytes. In other words, the length of the record may exceed the length of the line on the display



screen. When working with the document "Calculation of Equipment Workload," the length of the line is 194 bytes.

The assortment of instructions and codes that the user can put in from the console is not large. They may be divided into groups such as those indispensable to know, those desirable to know and those that are dispensable. The indispensable instructions are: press the input key BB, print the contents of the screen PEKR, print the entire document PECh, call up the document by code of noncomplicated structure KO, and completion of work with document NETs.

Among the instructions which it is desirable for the user to know are: shift the text several lines up or down, shift the text several columns left or right, move several pages forward or backward, set the visual field at the required line or column, set the visual field at the place of the document containing a specific text. These instructions are given by one or two characters. For example, +5 indicates shifting the text 5 lines upwards.

Nonessential instructions enable a changing of the document: excerpting, rearrangement of columns, or prearranged instructions for changing the document (including instructions determining the size of the page).

For example, for the aforementioned document, the instruction RL = 194.11 indicates that the number of lines per page is 11 (since the screen of the YeS-7066 display cannot accommodate a larger number of lines), while the number of characters per line is 194.

The information language of the computer uses the byte as the basic unit of information. When working with documents, it is advisable to use lines, pages, graphs or items, instead of bytes. The INES interactive language has special equipment for converting from bytes to graphs (columns). For example, the instruction RK = 19, 6, 10, 13 X 11, 16 establishes the dimensions of the columns in bytes, the notation 13 X 11 indicating that the document has 13 columns of 11 characters each.

The instruction VK = lets us indicate which of the available columns of the document are required to be put up on the screen and in what sequence. For example, VK = 1, 2, 4, 6, 3, 8, 12 puts up on the screen, not all the columns, but only some of them.

The desirable instructions also include such as allow the user to select prepared document presentation formats. The titles of these instructions are established by the enterprise. For example, the instruction SHLIF calls up data pertaining solely to grinding equipment. Such instructions are matched up with prearranged groups of activities, the execution of which is initiated by the appropriate code sequence (SHLIF). In our example, the code SHLIF corresponds to the following instruction, entered in a special file: (SHLIF) (RL = 194, 11, RK = 19, 6, 10, 13 X 11, 16, S2, L1, K1, VK = 1, 2, 9).

The nonessential instructions include such as require special (perhaps only slight) training of the user. These instructions are used by the interactive designers, i.e., the specialists preparing the data for the manager.

The user has the option of printing what is shown on the screen (instruction PEKR) or the entire document (instruction PRINT) or any given portion of the document once the parameters of that portion have been specified.

Issuing of the above instructions from the console is not difficult, but does require skill and time. This hampers the managers of the enterprise and the shops, to whom each minute is valuable. It is therefore possible to use the option of prearranged screen formats. By selecting the titles of instructions shown in the lefthand brackets on the screen, one may instantly see the results of their execution on the screen. This is a more convenient operating procedure, but requires preliminary preparation and restricts the selection possibilities. It is possible to use both procedures simultaneously.

The assortment of preliminary format instructions may be quite large and include the identical instructions under different titles. The titles are constructed on the basis of optimal understanding by the manager. For example, if it is required to begin an examination with the column corresponding to a certain type of equipment, the instruction may be assigned names reflecting its number or title. Furthermore, it is possible to request a position for beginning of examination in a document with coordinates not known in advance. In this case, we use the instruction of data retrieval in terms of a specified value or text. For example, the instruction I'FREZERNOYE' positions the visual field at the column corresponding to milling machines.

The next document is examined by giving the instruction KONETS and the code of the new document.

Working with documents entails a movement from one to another and a selection of the inspection zone. To simplify this work, a scenario is constructed, determining the path of movement through the documents in advance. At each point on the path it is possible either to continue it by pressing the key VV (computer input) or to return to a certain place in the document by requesting a different point by the specific character.

It is necessary to find such pathways with the manager working behind the console as assure minimum time of data retrieval, decision-making and optimal decision-making.

The components of the pathway of the manager's work at the display console are the operations of finding and transformation of data. The manager should be able to himself formulate the pathways of work with data, for which these processes must be formalized. It is convenient to carry out the formalization in accordance with the rules of relational algebra, and to use the INES interactive software as the basic program. In this case, the operations of the manager working at the display console are interpreted as a group of actions aimed at producing various projections of a relation (document), the union and difference of relations, the formation of their Cartesian products and selections.

It is also helpful to represent the group of pathways enabling efficient work of the manager at the display console in the form of relations whose projections are selected by the manager at each given instant of time.

In relational algebra, a document is represented in the form of a relation  $D$ , characterized by a given  $N$ -arity. In this case, the relation  $D$  consists of a set of taples, the length of each of which is  $N$ . In practice, the route represents a group of values of the indexes contained in one line of the document.

The most frequent operation (component of a pathway) is production of a certain projection of a document (relation). The basic procedure of such operation is the removal of certain components of the routes comprising the relation, followed by regrouping (if desired) of the remaining components.

A projection can be defined as follows. A document consisting of  $n$  columns represents a relation  $D$  of  $N$ -arity. The scheme of the relation is  $D(\Pi_1, \Pi_2, \dots, \Pi_n, \dots, \Pi_N)$ . Each line of the document is a route, the components of which are the values of the indexes  $\Pi_1, \dots, \Pi_N$ . The projection  $\pi_{n_1, n_3, n_N}(D)$  is the group of taples having the values of the indexes  $\Pi_1, \Pi_3, \Pi_N$  as components. The interactive system has built-in modules realizing the operations of projection. The simplicity of the instructions and the ease of issuing them allow the manager to participate (within certain limits) in the designing of the data processing at his own discretion and allows an automation of the design process.

Experiments show that the use of such system in pilot manufacture, where a sizable amount of the documents arrive in the form of notifications of changes in the technology, design or production schedules, or in the form of various kinds of memos, requiring a careful coordination of their contents, considerably simplifies the work of the managers and frees them from noncreative work.

It is highly effective to carry out simultaneous work sessions of the managers at the console (five minutes, operational sessions ("operativki"), etc.). This brings out discrepancies more clearly, avoids creating shortages of commodities, and simplifies the resolution of mutual claims among the shops, as the information proceeds from a single source to all of them, changes are introduced only by the administrator, and the information is always in timely condition. Presentation of information on the display screen in terms of any given requirement substantially simplifies the document flow, while the input of data to the format base and the work with this base enable an easy formulation of production schedules in interactive mode and a monitoring of their accomplishment.

It is not difficult to master the principles and techniques of working with the system. All the basic actions can be acquired in a single 20-30 min session, which is sufficient for independent work. Total mastery of the

working procedures at the manager level is possible in two or three sessions of 20-30 min each, while at the level of the manager's assistant, untutored in the methods and procedures of computer data processing, but having the task of preliminary preparation of data for the manager, it takes four or five sessions of 30-40 min each. After this, the manager and the assistant will be independent of the system developers, and will be able to use the system and intervene (within certain limits) in the operation.

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## BYELORUSSIAN GOSBANK ASU REVIEWED

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[Article by V.V. Zayash, director, branch computing center, Byelorussian republic office of Gosbank, and V.S. Markhel, assistant director of the branch computing center: "ASU in Action"]

[Text] The automated management system (ASU) of the Byelorussian republic office of Gosbank is part of the OASU [branch of ASU] of the USSR Gosbank and is designed so that that Gosbank can best serve both economic organizations and the population at large.

Design of the ASU lasted from 1981 through 1984. The first stage of the ASU for the Byelorussian office of Gosbank was accepted for service in December, 1984. The standard design solutions for the USSR Gosbank OASU, of which were developed by the Gosbank branch office computing centers for the Volgograd, Novosibirsk, Sverdlovsk and Odessa oblasts, and by the Ukrainian republic office, have found broad application in the ASU.

The main goal in developing and introducing the first stage of the ASU was to automate the mass-scale processing of primary monetary-accounting documents so as to ensure that industrial accounting is accurate and timely, as well as to ensure improving and raising the quality of management.

The first stage of the Byelorussian republic office of Gosbank ASU consists of two parts: support and functional. The functional part contains four subsystems: accounting-operational work, bookkeeping and statistical reports, capital turnover control, and credit control. The support part consists of hardware, software, data base and organizational-methodological sections.

Input data for the accounting-operational work subsystem takes the form of primary bank documentation on accounting monetary-accounting operations for the day they were completed, and machine-stored files of information which contain the results of the previous calculation.

The operational accounting program package does opening and closing balances of individual accounts, changes information on them, and recomputes the balance of individual accounts upon closing. The program package automates individual accounts and tracks changes in the balance of the individual accounts of economic organizations, automatically adjusts

871-type joint balance accounts with Gosbank organizations under single offices, as well as 870-type joint balance accounts with Gosbank organizations under multiple offices. The program computes daily balance, compounded interest, quarterly bank income from repayment of calculated, current, and special loans, payment for encashment of receipts, etc. While performing bookkeeping operations the program collates analytical accounting with synthetic. The average daily volume of documents processed has reached 55,000, covering 70,000 individual accounts of economic organizations.

The MFO [inter-branch transactions] Receipting suite of tasks receipts reciprocal MFOs for Gosbank organizations serviced by the ASU. Data from initial remittances come in for receipting by mail and wire at a rate of 20,000 documents daily. Information for reciprocal remittances are taken from the data file used for the Operational Accounting task. Gosbank organizations receive data on the following: remittances that have or have not been receipted with or without tables; analysis of unreceipted remittances; list of reciprocal remittances received; extraction of the changing remainder of reciprocal remittances, unreceipted after 40 days; documents drawn up to reflect the results of balance receipts.

The MFO Control program package operates at the branch office level. It processes documents on the initial MFO from subsidiaries of a given branch office. For our ASU that includes all the Gosbank organizations of Byelorussia. The MFO control package checks the accuracy of records on the initial MFO, computing individual accounts (tables) for B-subsidiaries, compounding turnover from the beginning of the year for A- and B-subsidiaries, and closing the year by computing the final balance MFO.

The Bookkeeping Statistical Reporting subsystem creates forms for bookkeeping and statistical reporting to be used by organizations served by Gosbank.

The program package of statistical reporting for divisions keeps records on the following: balance of debt overdue to Gosbank; unpaid balance on short-term Gosbank loans; financing of state capital investments and other initiatives in agriculture; corresponding sub-accounts of Stroybank; financing of capital repair and use of industrial development funds; operational accounting of the use of state budget cash; monthly accounting of the use of state budget cash with annotations; monthly reporting balance; confirmation on the funds of rayon, municipal, rural and village budgets, etc.

The program package for statistical reporting for the oblast offices puts out reports based on data output from analogous division-level tasks, as well as on data from records sent in by mail or wire from Gosbank organizations not using the ASU. That includes the summary accounts on the balance remaining on Gosbank's short-term loans; remaining balance on currently overdue loans and remaining balance on overdue monetary notes; long-term credit for enterprises, organizations, kolkhozes, and the population; long-term credit for individual housing construction projects and entry into operation of housing; turnover of separate balance and out-of-balance accounts; accounts of economic organizations based on mutual credit claim; accounting of additional information about balance; distribution of salary funds by industrial and other enterprises that receive

varying salary funds based on plan fulfillment; distribution of salary funds by construction and by-contract concerns that receive varying salary funds based on plan fulfillment; distribution of salary funds by agricultural and other enterprises, budget and cost accounting organizations that receive salary funds within the limits of an approved fund; financing of state capital investments and other agricultural undertakings, account on the use of state budget cash; accounting of the final balance, etc.

The management of monetary turnover subsystem draws up the projected quarterly cash plan for a Gosbank division on the state's quarterly plan indicators for economic and social development, which includes monthly distributions, depending on the source of incoming funds and the recipients of outgoing cash. The subsystem also takes in chief indicators for cash planning, as well as accounts on cash plan items.

The programs in the credit management subsystem are designed to automate regulation of credit transactions between the bank and trade organizations; to keep account and redistribute confirmed short-term credit plans; and to "put to press" economic drafts for workers in the credit divisions of Gosbank organizations.

The technical-working design of the Byelorussian republic Gosbank office ASU was worked out in conjunction with the basic design solutions and requirements of the Technical Design for the USSR Gosbank OASU in the area of the hardware and systems and applications software.

The ASU hardware for the Gosbank Byelorussian office is made up of equipment from the branch computing center of the Gosbank Byelorussian republic office, a data transmission system, as well as terminal and maintenance equipment.

The computing center's equipment consists of two VK-1033 computer systems and is used for bank data input and processing, and also for carrying out design work.

The data transmission system for the first stage of the Byelorussian Gosbank republic office ASU is made up of hardware to be used with data transmission equipment, peripherals, terminals and communications channels, as well as a specially developed group device for connecting the computer with communications channels.

The VK-1033 units are connected to communications channels through a group communication device compatible with the YeS computer system, which supports multi-channel communications (up to 32-tone frequency communications channels) with peripherals, and, through them, with terminals installed at Gosbank offices.

The data transmission system for the first stage of the Byelorussian Gosbank republic office ASU is one of the republic's most advanced in terms of number of users served. The system users primarily physical transmission lines as well as non-switched 1200-baud telephone and 100-baud



telegraph communications channels. It includes 62 communications channels up to 350 kilometers long. The first ASU stage serves 33 Gosbank organizations with 120 terminals used for transmission, including 84 teletypes and 36 terminals. Nearly all the terminals come with a detachable numerical keyboard. One work station can normally transmit 1000 documents per shift.

A 12-unit peripheral hardware complex performs primary logical input control. It also serves as a concentrator, thus lessening the number of information channels in the data transmission system.

Data is entered remotely in double shifts from 8:00 am to 5:00 pm. The processed output is delivered by track or car to Gosbank organizations in Minsk and by railway mail and communications channels to organizations in other cities.

Software for the first stage of the Byelorussian Gosbank republic office ASU consists of systems and applications programs. The systems software is based on the OS YeS operating system, version 6.1, 9th edition, which functions in multi-tasking mode with variable number of tasks. In addition the package includes a broadened service program to automate standard technological operations on the computer; a time-sharing system; PL/I compilers (optimizing and debugging), Assembler-N, Assembler-K, which help optimize programs; and a diagnostics package for on-line testing of external devices while working.

The applications programs (approximately 500 program modules) are written in Assembler and PL/I in modular form and are included in the library data sets.

Data support takes the form of a system for classification and coding, machine and non-machine data bases, and an automated system for the input of norms-reference information. The classification and coding system is based on three sub-classifiers: type of bank document; monetary turnover; and a general union classifier for enterprises and organizations (under the division of Gosbank organizations), which taken together, allow coding of all items of the first stage of the ASU. The non-machine data base consists of 185 output forms. The machine data base contains 478 files on magnetic disk packs. The files supply the data necessary for all job operations. An applications program package developed by the branch computing center of the Byelorussian Gosbank republic office called "Logical System for Control of Norms-reference Information Base" provides for automated maintenance of norms-reference information basically independently of the applications programs.

Organizational-methodological support includes a package of documentation outlining the users' interactions, their new duties, as well as methods on preparing Gosbank organizations for working with ASU and for implementing the system.



The effectiveness of the introduction of the first ASU stage is ensured by an increase in the labor productivity of bank specialists through automation of the most labor-intensive operations of processing and control onto a qualitatively higher level, by improving approval and accounting methods for credit, monetary turnover, bookkeeping and statistical record keeping, and by raising the accuracy and trustworthiness of accounts handled by Gosbank. The annual economic benefit accruing from the first stage of the ASU (according to our estimations) comes to 106,200 rubles. The system will pay for its own development, implementation and operational support in 4.5 years.

The design decisions from the first stage of the Byelorussian Gosbank republic office ASU has already found practical application in the computing centers of the Tatar and Bashkir republic offices, as well as in the Sverdlovsk and Saratov oblast offices. The computing centers of other offices, including those for Kuybyshev and Denpropetrovsk are making plans to implement ASU.

In this connection we should note that with the implementation of the first stage of the ASU there has been a noticeable increase in the number of organizations served by Gosbank. Thus whereas at the start of the 11th Five-Year Plan the branch computing center of the Byelorussian Gosbank republic office along with the IVS [information computing system] of the Mogilev Gosbank oblast office used only mechanized data processing for all of 26 Gosbank organizations, by 1 Jan 1985, including the computing centers of the Vitebsk and Gomel' oblast offices, which are equipped with M-5010 systems, the accounting operations of 76 organizations belonging to six of the seven Gosbank offices in the republic had been taken on for service. That comes to 52% of all the organizations and 70% of the entire volume of monetary-accounting data. Plans call for processing 80% of all accounting documents by the end of the Five-Year Plan.

Subsequent stages of the Byelorussian Gosbank republic office ASU should include all of Byelorussia into a technologically unified system for data transmission and processing of bank documents.

The collective of the branch computing center of the Byelorussian Gosbank republic office is ready to master new technology and to develop further the structure and forms of economic activity using ASU for the Gosbank organizations of Byelorussia.

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THE SEGREGATION OF CLASSIFIABLE SUBJECTS AND THEIR INTERRELATION IN THE DESIGN OF AN INFORMATION-LOGIC SCHEME FOR A DATA BANK

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[Article by M. P. Kruglova and L. A. Malinskiy, TsPTI (expansion unavailable) of the all-union association, Soyuztorgsistema, under the general heading "ASU Software. General Problems of Classification, Coding, and the Unified System of Documentation."]

[Text] In designing an information base for a system, the formation of functional and intra-system requirements for data and for data storage organization has great significance. These requirements are determined by means of analyzing the document turnover of an enterprise and in the process of formulating problem statements.

The following information is necessary for formulating data bases:

- names of subjects;

- names of data elements;

- types of associations, with instructions for coupled entries;

- expected frequency of access to data and types of data entry processing;

- assumed quantity of data elements that define the subject and is necessary to estimate the size of the data base and the performance of the system, which depends on the length of the information search chain in the data base;

- characteristics of data elements (length, type, and format);

- types of processing for each element; and

- data sources.

For the data that define the subject, it is necessary to indicate whether the sources are inputs or represent the result of calculations.

Interrogations of the data base are formulated up to the definition of algorithms for functional processing on the basis of output forms and the economic content of the problems being solved.

The originally formulated interrogation to the data base can be changed during analysis. For example, an interrogation was originally formulated as follows: "Determine the nomenclature of products of an enterprise with indication of the materials used." After analysis, this interrogation was edited as follows: "For the given ENTERPRISE provide a list of its PRODUCTS with indication for each PRODUCT of the materials used." The correctness of the formulated interrogation should be confirmed by the requestor.

A set of functional relationships is arrayed against each interrogation. A functional relationship is an element of the information-search algorithm. It does not describe the algorithm for functional processing, but only indicates the sequence for choosing examples of subjects for processing.

In the input of a functional relationship, one example each is used for one or several subjects referred to as "initial" and, in the output, examples of one or several subjects referred to as "final."

A functional relationship in which one initial subject is given is called "univariate"; the remaining ones are "multivariate."

If two subjects appear in one functional relationship, consequently, between these subjects there is a mutual relationship or correspondence. It is possible to distinguish the following four types of correspondence:

A 1:1 (one to one) type of correspondence between the two subjects A and B designates that to each example of subject A there can be a correspondence of a maximum of one example of subject B and, inversely, to any example of subject B there can be a correspondence of a maximum of one example of subject A. As a rule, with this type of correspondence, the two subjects are combined into one and, therefore, this type of correspondence will not be examined.

A 1:M (one to many) type of correspondence between subjects A and B denote that there can be examples of subject A to which more than one example of subject B correspond, but a maximum of one example of subject A can correspond to each example of subject B. For example, between subjects FATHER and SON exists a 1:M type of correspondence.

An M:1 (many to one) correspondence between subjects A and B denotes that the maximum of one example of object B can correspond to each example of subject A and among examples of subject B, there can be those to which several examples of subject A correspond. If the type of correspondence between subjects A and B is M:1, the type of correspondence between B and A is 1:M (true and inverse statement). In the example examined above, there is an M:1 correspondence between SON and FATHER.

An M:M (many to many) type of correspondence between the subjects A and B denotes that there can be an example of subject A that corresponds to several examples of subject B and the reverse.

If the type of correspondence between subjects A and B is M:M, the type of correspondence between subjects B and A is also M:M. For example, For example, if between subjects ITEM and WAREHOUSE a type M:M correspondence has been determined,

this means that the same item can be delivered to various warehouses but, at the same time, one warehouse stores various items.

Types of correspondence are determined in the design process. For example, to determine the type of correspondence between the subjects ENTERPRISE and ITEM, it is necessary to know whether one enterprise can put out several types of items and whether items of one type are put out at various enterprises of the industry. If the answer is affirmative, the type of correspondence between subjects ENTERPRISE and ITEM will be M:M.

Let us examine the example of designing a data base for a complex of problems of the subsystem "Bookkeeping Account" with the example problem "Account of Acquisition of Items by Warehouses" (ASU-Myasomoltorg).

The interrogation by the user has the following form: "It is necessary to obtain information on the acquisition of items from consigners to sections of a refrigeration combine." Information on the acquisition of items by sections of the refrigeration combine is contained in the document, "receiving statement." The output information on the problem consists of the following printouts: "Register of items according to refrigeration combine, technological shop, section, operation, and group of items" (daily printout) and "cumulative register of receipt of an item for a given month according to refrigeration combine, technological shop, section, operation, and group of items."

The receiving statement contains the following information: document code, receiving statement number, date of receiving statement, section code, supplier's code, item name, item code, price; operation code; quantity of places, gross weight; and net weight (actual receipt).

The outgoing document is printed out by section and by operation. The operation code is tied to the form code, and the formation of information by operation code is done algorithmically; the operation does not take part in the interrogation. Information on the acquisition of an item is put out by item code with indication of the number of the incoming document, name of the item, quantity of the item according to the document, and the sum of the item with totals made according to item, item group, and section.

On the basis of the economic substance of the problem and of the input and output information, the subjects are selected and their characteristics described. To solve the problem under examination, the subjects ITEM, SECTION, and DOCUMENT are selected and the following interrogation is formulated for the data base: "Determine the acquisition of the item according to each section, each item, and each document." The selected subjects are included in the text of the interrogation.

The following combination of functional relationships are associated with the given interrogation:

F SECTION, ITEM, DOCUMENT  
ACQUISITION

If the sequence of the functional relationship consists of univariate relationships, it does not require conversion. But if multivariate relationships are defined in the sequence, they have to be introduced in simpler form. SECTION, ITEM, and DOCUMENT are referred to as initial subjects. This is a multivariate relationship, since several initial subjects are present in the interrogation. Let us examine the conversion of this multivariate relationship and an algorithm for doing it.

The correspondence between the initial subjects SECTION and ITEM is M:M and between ITEM and DOCUMENT, M:M. Changing the sequence of initial subjects in the multivariate functional relationship, one obtains a functional relationship identical to the original, the order of the sequence having been changed so that the correspondence would be as if between two subjects, 1:M or M:1:

$$F \begin{matrix} \text{SECTION, ITEM, DOCUMENT} \\ \text{ACQUISITION} \end{matrix} = F \begin{matrix} \text{SECTION, DOCUMENT, ITEM} \\ \text{ACQUISITION} \end{matrix}$$

The correspondence between the subjects SECTION and DOCUMENT is defined as 1:M.

Such a result can be obtained by separating out the multivariate relationship of a chain of subjects among the initial subjects.

If a correspondence 1:M is given for subjects  $A_i$  and  $A_j$  ( $1 \leq i < j \leq N$ ), they form a chain. If a chain of subjects can be separated out among the initial subjects of a multivariate relationship, the conversion of the sequence of this relationship consists of exchanging it for an identical one.

For example, the sequence is given for functional relationship

$$F \begin{matrix} A_1, A_2, \dots, A_k, A_{k+1} \\ B, \end{matrix}$$

where  $A_1, A_2, \dots, A_k$  form a chain.

The following functional relationship is the same as this multivariate relationship:

$$F \begin{matrix} A_1 & A_2 & A_{k-1} & A_k, A_{k+1} \\ F & F & F & F \\ A_2 & A_3 & A_k & B \end{matrix}$$

To separate out the chain of initial subjects, a table is constructed that has the following form:

Initial Subjects	Item	Document
SECTION	M:M	1:M
	ITEM	M:M

If at least in one box of the table a type of correspondence is given different from M:M, then it is possible to separate out a chain among the initial subjects:

$$F \begin{matrix} \text{SECTION, ITEM, DOCUMENT} \\ \text{ACQUISITION} \end{matrix} = F \begin{matrix} \text{SECTION, DOCUMENT, ITEM} \\ \text{ACQUISITION} \end{matrix} =$$

$$F = \begin{matrix} \text{SECTION} \\ \text{DOCUMENT} \end{matrix} F \begin{matrix} \text{DOCUMENT, ITEM} \\ \text{ACQUISITION} \end{matrix}$$

Each multivariate functional relationship as a result of the conversion leads to a set of univariate relationships or a set of univariate and one multivariate functional relationships among the initial subjects which are not a chain.

$F \begin{matrix} \text{DOCUMENT, ITEM} \\ \text{ACQUISITION} \end{matrix}$  - A multivariate functional relationship can be transformed in sequence

$$F \begin{matrix} \text{DOCUMENT} \\ \text{ACQUISITION} \end{matrix} \quad F \begin{matrix} \text{ACQUISITION} \\ \text{ITEM} \end{matrix} \quad F \begin{matrix} \text{ITEM} \\ \text{ACQUISITION} \end{matrix} \quad F \begin{matrix} \text{ACQUISITION} \\ \text{ITEM} \end{matrix}$$

Thus, the resulting sequence of the functional relationship is transformed to the following simpler form:

$$F \begin{matrix} \text{SECTION, ITEM, DOCUMENT} \\ \text{ACQUISITION} \end{matrix} = F \begin{matrix} \text{SECTION} \\ \text{DOCUMENT} \end{matrix} F \begin{matrix} \text{DOCUMENT, ITEM} \\ \text{ACQUISITION} \end{matrix} F \begin{matrix} \text{ACQUISITION} \\ \text{ITEM} \end{matrix}$$

In order to begin the implementation of the sequence of functional relationships, it is necessary to establish the first functional relationship by referencing the initial subjects. For these subjects are given the characteristics that determine the means for referencing examples of the subject. Characteristics of the reference can be:

D - direct reference according to the meaning of the subject identifier;

S - sequential reference to subject examples; and

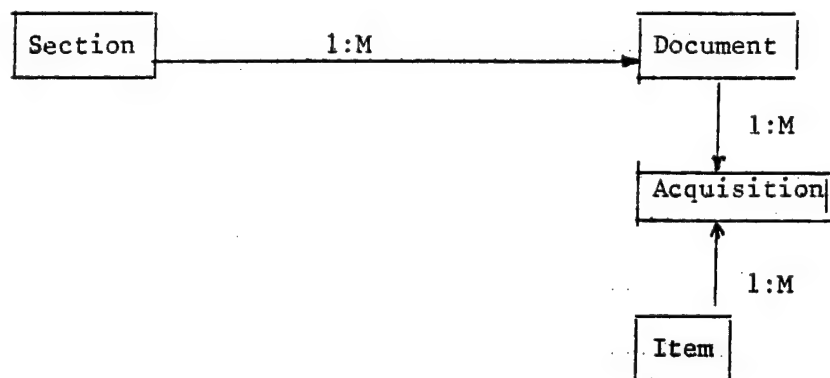
DS - simultaneous provision of direct and sequential reference.

The meaning of the characteristics of the reference is determined from the text of the interrogation. When the name of the subject is made more precise by the word "given," this signifies direct reference to a specific example of the subject. If the text of the interrogation uses the word "each" before the subject, a sequential reference is assumed.

The functional relationship  $F \begin{matrix} \text{SECTION} \\ \text{DOCUMENT} \end{matrix}$  permits obtaining a list of all documents entered into the section.

The functional relationship  $F \begin{matrix} \text{DOCUMENT} \\ \text{ACQUISITION} \end{matrix}$  and  $F \begin{matrix} \text{ACQUISITION} \\ \text{ITEM} \end{matrix}$  permits establishing the quantity of the item acquired according to the given document for the item. The specified interrogation will be implemented as follows: all documents are determined according to each section, and the quantity of the acquired item is taken according to each document. Then you proceed to the following document of this section and verify whether the given item has been acquired according to this document. If it has been acquired, you establish the quantity of the acquired item; if it has not been acquired, you proceed to the next document.

As the result of the accomplished transformation, you construct an infological scheme for the data base:



In connection with the task of the characteristics of the subjects, an analysis is conducted of the attributes stored in the data base. Initial and summary indices are used for this. Summary indices include total, intermediate, and any statistical data. The choice of solution whether to store summary indices in the data base or to enumerate them each time as a requisite, depends on the frequency of their use, the presence of memory capacity, and provision for preservation.

Sometimes it is necessary to preserve summary data even after the data upon which they were based have been refined. If the summary data are preserved in the data base, they should be distinguished by name from the data that they comprise.

The data base can be expanded by introducing additional relationships and duplication of data elements for effectiveness in implementing interrogations.

A data base is constructed analogously when implementing requirements for other problems. Uniting these bases, an integrated infological data base can be obtained which then should be put in the form that satisfies the requirements of a specific data base management system.

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9645

CSO: 1863/216

## SPECIAL FEATURES OF USING THE SPEKTR DATA-BASE MANAGEMENT SYSTEM IN AN AUTOMATED SYSTEM FOR MANAGING CLASSIFIERS

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 2, Feb 86 pp 8-15

[Article by S. A. Vilkov and A. N. Klimenko, Karelian Scientific Research Institute of the Forest Industry, under the general heading "ASU Software. General Problems of Classification, Coding, and the Unified System of Documentation.]

[Text] The majority of functions for managing a vocabulary base are implemented with the aid of the SPEKTR Data Base Management System.<sup>1</sup> At the same time, the application of a data-base management system of this type requires special measures to conserve disc memory. One of the methods for solving this problem, relating to the automated system for managing classifiers of the automated management system for the logging industry (ASUOlz), is described below.

Structurally, the SPEKTR data base consists of an associative network, an area for data storage, and a working area. The data storage area is represented for the user in the form of a file set. Each file is identified by a number. Such a structure for the data storage area requires definite nonproductive expenditures of time for locating the heads during a one-time access to the information in various files.<sup>2</sup> But on the other hand, the system minimizes the time for searching for information within the boundaries of one file. With these aims, the resource management algorithm used in the data-base management system provides for separating out the whole number of cylinders for data-base files. All of the memory removed to the file is preserved and inaccessible for use by other files. Thus, however small the file, the capacity of most classifiers in ASUOlz does not exceed  $10^4$  symbols, and for holding a file 137 kbyte will be allotted on a YeS 5261 disc package or 233 kbyte on a YeS 5266 disc package. This, in turn, means that on one YeS 5261 disc package there cannot be more than 200 data base files; the load of classifiers in the ASUOlz in the form of individual files does not allow the package to be used more than 5% (the actual capacity of the package is 1450 kbyte for the YeS 5261 disc package and 5000 kbyte for the YeS 5266 disc package).

Table 1 shows the distribution of external memory for classifiers used in ASUOlz. The percent of use of removed memory is proportional to the dimension of a record and the quantity of records. Since, for a specific classifier, these parameters are permanent, it is necessary to find artificial techniques for increasing the utilization factor of the external memory.



Table 1

Classifier		Record		Quantity of Units (Used/ Separated Out)		Use of External Memory, % (YeS 5261/ YeS 5266)
Code	Title	Size (byte)	Quantity	Yes 5261 (size of unit -- 3140 byte)	Yes 5266 (size of unit -- 3500 byte)	
5 AY	Economic sections and groups of lumber types	25	9	1/40	1/76	0.2/0.1
9 BR	Groups and categories of technical suitability and categories of size and kinds of lumber	45	54	1/40	1/76	1.7/1
1 AT	Notation of measurement units used in the ASU	53	91	1/40	1/76	3.5/2
3 AT	Accounts and subaccounts of a bookkeeping account	84	241	5/40	5/76	14.5/8.5
	Extended file ("vertical linkage")	90	1870	60/60	54/76	100/71
	Extended file ("horizontal linkage")	3192	241	61/61	55/76	100/72

The problem can be solved by an informal application of the principles of relational data bases. Most classifiers and lists used in the OKTESP [expansion not available], including the lists examined below of the All-Union Classifier of Personnel Information, are presented in the fourth standard form (3), which is more convenient from the point of view of data manipulations. The special feature of the SPEKTR database management system is that for the interrogation FIND RECORD IN FILE MS. <SEARCH CRITERION>, the system puts out only the quantity of records satisfying this criterion.\* To obtain the located records, it is necessary to describe them, that is, to indicate a list of required fields and their sequence -- <DISPLAY FIELD 1> <FIELD 2>. Thus, not only the structure of the interrogation but also its actual content is independent of whether the record consists only of fields indicated in the interrogation or it contains other fields possibly not logically related to the requested ones. On this basis, it is possible to "link" several classifiers to the file as shown below.

\* The interrogation is made without being tied to the syntax of the language of a specific SPEKTR component.

a. Logical Presentation of File Structure

Economic Sections and Groups  
of Lumber Types

Code	Name
01	conifer
02	deciduous
03	pine
04	spruce

System for Designating Measurement  
Units Used in the ASU

Code	Abbreviated Name	Full Name
003	mm	millimeter
004	cm	centimeter
006	m	meter
008	km	kilometer

Code	Name	Code	Abbreviated Name	Full Name
01	conifer	003	mm	millimeter
02	deciduous	004	cm	centimeter
03	pine	006	m	meter
04	spruce	008	km	kilometer

b. Physical Presentation of File Structure

A1 1	A2 2	A3 3	A4 4	A5 5	A6 6
		020	017		
		021	018	013	record M
		022			
	100				
	101			014	record N

Structure of the "Horizontally Linked" File

Parameters of such a file are introduced in Table 1. The record of the file consists of logically unrelated records of several classifiers (a. Logical Presentation of File Structure) and the quantity of records is determined by the number of records of the largest classifier (b. Physical Presentation of File Structure). The unavoidable incompletely filled fields with such a structure are overwhelmed with the loading of the file, so that the memory on the magnetic disc is used only for substantive information. In this, no changes take place in the procedure for access to a specific classifier, since it is determined by the substance of the descriptor field, individual for each classifier (fields A1-A6, see above), and by the list of

required fields. An additional effect from using the file in such a structure is expressed by the possibility for accomplishing corrections of the "add" type by means of SPINTER for all classifiers except the longest. Thus, using descriptor A3 to find record M, in which field A4 has not been defined, one can add a record to classifier 4, for example A4 = 0.18 (above). For comparison, record N is represented as the addition of a standard SPEKTR utility.

An alternative to "horizontal linkage" is "vertical linkage." in this case, the records of all classifiers are put in one structure and are loaded sequentially one after the other. Some increase in the record length is compensated for by compressing the data in storage. Two variants of "vertical linkage" are possible: with the declaration of an additional descriptor field, CLASSIFIER CODE, and without the addition of a new field.

The second variant has substantial shortcomings: the necessity for continuous numbering of the CODE field for all "linked" classifiers and the impossibility of using the utilities of the data base management system to add records to an individual classifier. These shortcomings do not permit the application of this method.

The "vertical linkage" variant with the declaration of an additional descriptor field (the size of the record of this file is determined by the size of the largest record from the classifiers being "linked") is shown for the example of the System for Designating Measurement Units Used in the ASU (see below). "Empty" records (records 002 00400, 002 00401, and 002 00402) can be organized in the file to provide the capability to add records to the classifier in an interactive mode by means of SPINTER. To add records to the classifier, the utility, ADDITION (records 001 00007, 003 15000, and 002 00340) can be used. The fact that the additional records are found at the end of the file and are not dispersed according to corresponding classifiers does not have any significance for the user, since, during access, they are attached to the requested classifier. The file parameters are introduced in Table 1. The most important features of "linked" files and file systems, each of which uniquely corresponds to an ASU01z classifier, are given in Table 2.

The results of comparative analysis of the examined structures for vocabulary data bases have shown:

the fundamental advantage of the "linkage" of files is the substantial increase in the utilization coefficient of external memory;

an additional effect of using "linked" bases provides the capability to free a number of files (in the example given, 68, with the maximum number of files in one base, 255); and

the "horizontal linkage" method has a number of advantages in comparison with "vertical linkage," including the following: the capability to form vocabularies of different structures; the absence of surplus (classifier code) and reserve (for dialog correction of the "add" type) fields; simpler technology for loading and operating; and others.

To implement the method, special software has been developed that permits the organization of the following variants to the technological process of loading a "linked" file:

# "Vertically Linked" File Structure

## Economic Sections and Groups of Lumber Types

Code	Name
01	conifer
02	deciduous
03	pine
04	spruce
System for Designating Measurement Units Used in the ASU	
Code	Name
Abbrevi- ated	Full
003	mm millimeter
004	cm centimeter
006	m meter
008	km kilometer

## Groups and Categories of Technical Suitability and Categories of Size and Sorts of Lumber

Code	Name
10000	usable trunks
11000	usable lumber
12000	fuel lumber
13000	waste

Classifier Code	Code	Name	
		Abbrevi- ated	Full
001	00001		conifer
001	00002		deciduous
001	00003		pine
001	00004		spruce
002	00003	mm	millimeter
002	00004	cm	centimeter
002	00006	m	meter
002	00008	km	kilometer
002	00400		reserve
002	00401		reserve
002	00402		reserve
003	10000		usable trunks
003	11000		usable lumber
003	12000		fuel lumber
003	13000		waste
001	00007		aspen
003	15000		green tree- top pulp
002	00390	hP	hectopascal

Table 2

Feature	Simple-Structure File Classifier	"Vertically Linked" File	"Horizontally Linked" File
Classifier identification	File number, name of descriptor field	Name and substance of an additional descriptor field	Name of descrip- tor field
Capability for forming vocabularies of various structures	Provided	Absent	Provided
Capability for adding records to an individual classifier:			
--in a package mode	Provided	Provided	Provided
--in an interactive mode	Absent	Possible only in the case of reserving "empty" records in each classifier	Possible for all classifiers except very long ones
Capability for adding new fields	Provided individually for each classifier	Provided simultaneously for all classifiers	Provided individually for each classifier
Capability to confer identical names to analogous fields of various classifiers	Provided	Provided	Absent
Capability for group correction of classifier fields	Provided by program user individually for each classifier	Provided by program user for all classifiers simultaneously	Provided by program user individually for each classifier
Capability to select data from several classifiers in one interrogation	Absent	Absent	Provided
Method for increasing external memory utilization factor	Absent	By means of increasing the number of records	By increasing the length of a record

loading of one classifier (LOAD utility) in the data base file being formed; the definition of new fields in the file (FILE MODIFICATION utility); addition to the file being formed of classifiers of sequential files of an operating system (user program); and

loading of classifiers in the form of data base files of simple structure (LOAD utility); sequential "linkage" of data base files with automatic definition of new fields in the resulting file (user program).

The following are additional possibilities for software developed:

the capability to change a field (or several fields) in all records of a data base management system to new ones brought from a sequential file of an operating system or a data base file;

the capability to create data base management system files from the records of several data base management system files. A file of such a structure is a convenient tool for implementing interrogations to the base that request the output of data from several files (the operating version of a data base management system provides criteria for search of several files, but the data are put out from only one file).

The proposed method has been implemented in 69 classifiers of the ASUOlz. Table 1 presents the characteristics of the file formed for ASUOlz needs. The method can be useful also for ASU functional subsystems.

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THE CREATION OF A UNIFIED PRODUCT NOMENCLATURE -- ONE WAY TO IMPROVE THE PLANNING BASE

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 2, Feb 86 pp 15-18

[Article by N. N. Fedotov, candidate of engineering sciences, Main Scientific Research Center for Management of All-Union Classifiers, and V. A. Zverev, candidate of economic sciences, USSR Gosplan, under the general heading "Development and Introduction of Classifiers and the United System of Documentation."]

[Text] The unity, integrity, and the quality of plans and the complexity and balance of plan sections largely depend on the accuracy of the information base, its flexibility, and correct organization at each level of management in the national economy.

An important element of the information base is the nomenclature for industrial and agricultural products. Nomenclature is used in many sections of the current and long-range plans and in balance sheets and plans for distribution at all levels of planning. It is one of the most dynamic parts of the information base. Annual examination of the nomenclature is brought about by such factors as the following:

- a change in the composition and content of problems being solved in planning;

- improvement of the economic mechanism, particularly the relationship between the level of centralized management of the economy and the administrative independence of enterprises, the development of trade-money relationships, the balance of resources and the level of demand for goods and services, and so forth;

- the progress of science and technology, and the appearance of new branches of the economy, new industries, and the updating of products; and

- the development of international economic integration.

The dynamism of the product nomenclature being planned and the peculiarities of the problems being solved at various levels of plan development (for example, the planning of the basic proportions of reproduction and the determination of nomenclature for deliveries according to concluded contracts) and the different degrees of specifics and details of nomenclature references are responsible for the lack of comparability

and lack of coordination of product groups among sections and types of plans, and this, in turn, is reflected in the quality of calculations.

The provision of unity and comparability of nomenclature references in sections of annual and long-range plans is an important way for improving the quality of plan development based on the provision of mutual coordination of plan tasks, comparability of data, automation of aggregation and disaggregation of information, and so forth.

Taking into account the changes in all sections of a plan and at all levels of management is a rather labor-consuming project. The utilization of computer technology permits the creation on machine media and with automation the maintenance of a general body of information with a unified product nomenclature.

A unified product nomenclature is the basis for a unified information base for planning. The functioning of such a system will permit the provision of a centralized formation of the entire product nomenclature and the achievement on its basis of individual nomenclature groups among various sections of the plan and various planning modes.

The creation of a unified information base for planning can be completed during the 12th Five-Year Plan. The development of automated management systems at various management levels based on creating local computer networks and automated work places for specialists in planning organizations permits the creation and automated introduction of the body of unified product nomenclature at each level of planning.

The work of creating a unified information base needs to be conducted in two stages, depending on the readiness of the processing hardware and on transmission of the data.

The first stage is the creation on machine media and the automated introduction of a Unified Product Nomenclature, used for making plan and balance calculations and for reference information service to specialists of USSR Gosplan divisions. The automated introduction of nomenclature will provide a specially created reference information system within the framework of the Automated Control System for Planning Calculations, which permits the solution of the problem of formulating special-purpose nomenclatures for developing sections of plans and balance-sheets and the problem of selecting groupings for certain substantive indices, for example, a resource deficit, the use of products in very important complex programs, and in export shipments.

In creating such a reference-information system, the following is necessary:

- to arrange in sequence and match principles for including types of products in plans by levels of planning;

- to provide for unity of content and treatment of nomenclature positions, their agreement by levels of plan management with the aims of achieving comparability of data and automation of aggregation and disaggregation of indices, norms, and standards calculated on the basis of nomenclatures; and



to unify the names of types and groupings of products and to provide for their unique coding in correspondence with the requirements of the All-Union Classifier for Industrial and Agricultural Products (OKP).

The problem of arranging in sequence and matching principles for including types of products in plans is related to questions of improving the economic mechanism: expansion of enterprise independence, improvement in planning the mutual relationships between cost and natural indices, the development of a system of norms and standards and natural balances, and so forth.

In addition to accomplishing the basic task for introducing a Unified Product Nomenclature on the example of the functioning of the given reference-information system, automated technology will be developed for a dispersed data processing network, providing a centralized storage for the whole body of the Unified Product Nomenclature and receipt of local information bodies of necessary nomenclature on mini-computers.

On the basis of the Unified Product Nomenclature, a series of information data bodies can be created, including such indices as materials content, per unit labor expenditure, volumes of production by product groups, qualitative indices, and others.

The system for introducing these data on computers permits efficient formulation of the necessary nomenclature and its grouping for accomplishing calculations of an analytic or forecasting character.

The second stage is the creation of calculation nomenclature in ministries and agencies, so as to provide the possibility for integrating information in USSR Gosplan on calculation nomenclature in ministries and agencies.

Work on the creation of a Unified Product Nomenclature can be conducted within the framework of further work on the development of automated management systems in ministries and agencies. In this, the general requirements for designing the whole system need to be taken into account.

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DEVELOPMENT OF INFORMATION CLASSIFICATION IN THE AUTOMATED SYSTEM FOR PLANNING  
CALCULATIONS DURING THE 12th FIVE-YEAR PLAN

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 2, Feb 86 pp 18-20

[Article by Yu. V. Startsev, Scientific Research Institute for Planning and Norms attached to USSR Gosplan, under the general heading "Development and Introduction of Classifiers and the United System of Documentation."]

[Text] Among projects for the design and introduction of the second round of ASPR (Automated System for Planning Calculations), the construction of a system for classifiers and vocabularies on the basis of the Unified System for Classification and Coding has important significance. In the 11th Five-Year Plan, automated systems were created for managing all-union classifiers; on the whole, the methodological problems of information classification in ASPR and the creation of a system of classifiers and vocabularies were solved; about 20 all-system classifiers and vocabularies were developed, including the Unified List of Economic Plan Indices; and local systems of information classification were developed in functional subsystems and in the ASPR's of union-republic gosplans. The software created, in most cases, permits the provision of unique identification of data at all levels of the planning system.

Experience in the introduction of classifiers has allowed the exposure of the shortcomings of existing classifiers and the difficulties related to their application. The introduction of classifiers and vocabularies into the practice of automating plan calculations has been implemented slowly; information classification systems developed at various ASPR levels have been poorly coordinated, and projects on information classification have been done without sufficient interrelationship with the unification of plan documentation forms and with the creation of other information sources.

The elimination of these shortcomings is a necessary condition for the transition, during the 12th Five-Year Plan, to the second stage of ASPR development -- the integration of plan calculations. At this stage, it is proposed, in particular, to create a unified computer network, to develop an interrelated information system, and to organize the interaction of subsystems, units, and tasks, and also of ASPR's with the ASU's of ministries and agencies.

The solution of these problems requires the activation of work on the utilization of classifiers and vocabularies in the practice of plan development and on their further development. The main features of this work are the following:

fundamental attention to be allotted to the broad introduction and improvement of classifiers and vocabularies already developed;

development of new ASPR classifiers and vocabularies to be implemented primarily "from below," that is, on the basis of synthesizing locally developed software and the generalization of user proposals;

provision for the broad utilization of computers not only for managing the existing vocabularies, but also for automating labor-consuming processes of developing new classifiers and creating special-purpose nomenclature and working vocabulary bodies; and

conduct of work on horizontal and vertical linkage of ASPR classifiers and vocabularies, that is, to create industry, republic, and all-system systems for information classification and to link them together.

As a whole, the development of the information classification system in ASPR should be conducted along the following lines:

the preparation of proposals for improving existing All-Union Classifiers of Technical and Economic Information and for the development of new ones, for example, for the development of all-union classifiers of norms and standards, measures for improving management systems, raising the technical level of production and new technology, and so forth;

the improvement of existing all-system and local classifiers and vocabularies and the development of new ones (thus, improvement is required in the ASPR Functional Subject Classifier; a classifier of plan documentation needs to be developed; and others);

the formation of working vocabulary bodies and special-purpose nomenclature based on classifiers that have been created (particularly, in top priority, it is necessary to develop, on the basis of All-Union Classifiers of Industrial and Agricultural Products (OKP), a unified product nomenclature usable in annual and five-year plans for the economic and social development of the USSR;

the development of instructional and methodological materials and organizational measures for the application of classifiers and vocabularies in ASPR (for example, for using classifiers and vocabularies for organizing information exchange, and the description of data for forming files in factographic systems, for the automatic generation of output forms, and so forth);

the creation of software for automating the development and management of vocabularies and classifiers; and

the linking of vocabularies and classifiers, including those in republics, that are being used at various ASPR levels, into a unified system.

The development of automated systems for managing classifiers and vocabularies should go the route of increasing the number of users, of increasing the effectiveness of introducing additions and changes, simultaneously informing subscribers of changes, expanding the array of services and improving their quality, and broad use of data exchange on machine media.

For increasing the effectiveness of work on automated systems for managing classifiers and vocabularies at various ASPR levels, it is necessary to provide for clear-cut interaction of these systems with one another and with the Main Scientific Research Center for Managing All-Union Classifiers of Gosstandart by means of data exchange on machine media.

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CONCERNING THE DEVELOPMENT OF A REPUBLIC ASSORTMENT PART OF THE ALL-UNION CLASSIFIERS FOR INDUSTRIAL AND AGRICULTURAL PRODUCTS IN THE UKRAINIAN SSR

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 2, Feb 86 pp 20-22

[Article by Z. G. Kozina, Main Scientific Research Center for Management of All-Union Classifiers, F. I. Polyakov, candidate of engineering sciences, GlavNIIIVTs (expansion unavailable) of UkSSR Gosplan, and N. A. Povstyanaya, GSKTB-mestprom (expansion unavailable) of the UkSSR Ministry of Local Industry, under the general heading "Development and Introduction of Classifiers and the United System of Documentation."]

[Text] The development of a republic assortment part of the All-Union Classifiers for Industrial and Agricultural Products (RA-OKP) in the Ukrainian SSR has been conducted in agreement with the "Methodological Instructions for the Development of RA-OKP (RD 50-287-81)" and "Methodological Instructions for the Classification of the Products of Practical and Domestic Art Trades and Souvenirs in the OKP (RD 50-343-82)."

In selecting products for inclusion, the UkSSR RA-OKP has utilized the lists of republic and union-republic ministries and agencies and of ispolkoms of oblast and city councils of people's depubies and also requests for obtaining OKP codes from developer organizations for normative-technical documentation for conducting registration of standards and technical specifications.

The analysis of information is conducted on the basis of active normative-technical documentation and price lists, after which the distribution of products is accomplished in classification groupings of K-OKP according to industry association, types, purpose, and other economic and technical indices.

The coding of products which pertain, according to the associated industry, to groupings of 96 9200-96 9800, has been conducted within the boundaries of separate republic codes in the assortment part. The listings of products in the RA-OKP includes type, the designation of products in correspondence with the normative-technical documentation governing their production, and article on the price list.

In 1983, for products pertaining to groupings of 96 9200-96 9800, an RA-OKP containing about 2000 positions was developed. In 1984, for these groupings, changes and additions of over 400 positions in volume were prepared and approved. The RA-OKP includes products produced according to 68 republic standards and 92 technical speci-

cations. A major portion of the products are being produced by enterprises of local industry.

For products pertaining to other classes and groupings of the OKP, lists were sent for coding to head organizations for OKP of ministries and agencies according to association. The remaining types of products were coded, and 420 codes were received for republic products. For products of the chemical and cellulose-paper industries, the head organizations for OKP allotted capacities (code series) for the RA-OKP UkSSR.

On the basis of the allotted capacities in 1984, changes and additions to the RA-OKP were prepared for groupings of classes 22, 23, 24, 54, and 59, containing 77 positions.

Management of the RA-OKP UkSSR is accomplished in agreement with the Statute on the Republic System for Management of Classifiers of Technical and Economic Information in the Ukrainian SSR.

Further development and improvement of the RA-OKP provides for the following: the collection and analysis of proposals for changes, the coding of new products and products previously produced but not included in the RA-OKP, responses to single requests from enterprises and organizations located in the territory of the republic, the creation and maintenance of information bodies and card indices, and the publication of the RA-OKP.

At the present time, RA-OKP codes are used in a number of industry ASU's, and are represented in standards and technical specifications during registration and the introduction of changes in them, in technical-level cards during product certification by two quality categories, and in unified document forms (for example, in supply and equipment support during the composition of requisitions for materials and equipment).

The general introduction of OKP codes will permit more effective conduct of work in creating rational product nomenclatures and its unification.

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DEVELOPMENT OF GROUP 4381, 'STANDARD MEASUREMENT AND CALIBRATION DEVICES,' OF THE ASSORTMENT PART OF THE ALL-UNION CLASSIFIER OF INDUSTRIAL AND AGRICULTURAL PRODUCTS

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 2, Feb 86 pp 22-24

[Article by T. Ya. Vlasova, Main Scientific Research Center for Management of All-Union Classifiers, and Z. S. Kosolapova, All-Union Scientific Research Institute of Metrology Service, under the general heading "Development and Introduction of Classifiers and the United System of Documentation."]

[Text] The assortment part of the All-Union Classifier of Industrial and Agricultural Products (OKP), "Standard Measurement and Calibration Devices," has been developed and approved. The assortment part includes standards and standard measurement and calibration devices, the technical standards documentation for which is being developed only by organizations and enterprises of the State Committee for Standards.

Structurally, group 4381 consists of two parts: classification and assortment.

The classification part contains five-digit coded classification groupings of products and is constructed with the use of the hierarchical method of classification and the sequential method of coding.

The assortment part includes types of calibration equipment coded with ten-digit codes.

The formula for the code structure for standard measurement and calibration devices has the following form:

$$XX + X + X + X + X + 0000 \text{ CN}$$

The classification characters are arranged in the following order:

two characters (1st and 2nd digits) = identification of industry;

one character (3rd digit) = sub-industry specialization;

one character (4th digit) = functional designation;

one character (5th digit) = types of measurements (for example, 43 8110 "Equipment for Measurements of Geometric Quantities," 43 8120 "Equipment for Measurements of Mass, Force, Hardness, and Movement Parameters," and 43 8140 "Equipment for Measurements of Electrical and Magnetic Quantities);

one character (6th digit) = equipment for measurements by complete calibration laboratories (for example, 43 8111 "Equipment for Hairline Measures of length," 43 8112 "Equipment for Outer and Inner Linear Measurements," and 43 8115 "Equipment for Measurements of Uneven Lines and Planes);

four characters (7th, 8th, 9th, and 10th digits) = specific products (arranged by serial coding method);

two characters (11th and 12th digits) - control number.

An OKP fragment, assortment part, is presented below:

Code	Control Number	Name	Identification Symbols
43 8130		Equipment for measurements of pressure, vacuum, quantity and flow of liquids and gases, viscosity, and density	
43 8131 0000	04	Equipment for measurements up to 250 MPa	
43 8131 1001	10	Working standard with upper measurement limit of 6 MPa	TU 50.267-82
43 8131 2001	06	Dead-weight pressure gauge tester (model MP 60M of the 0.02 precision class)	TU 50.418-84Ye
43 8131 2002	05	--model MP-60M of the 0.05 precision class	TU 50.418-84Ye
43 8131 2003	04	--portable model MPP-60 of the 0.05 precision class	TU 50.457-84
43 8131 2004	03	Surplus-pressure dead-weight pressure-gauge tester (MP-6 of the 0.02 precision class)	TU 50-472-84
43 8131 2005	02	--MP-6 of the 0.05 precision class	TU 50.473-84
43 8134 0000	06	Equipment for measurements of low pressures and vacuum	
43 8134 2001	02	Micromanometer (MKM) 4	TU 50.170-79
43 8134 2002	01	-- portable MP-KM	TU 50.388-83

The creation of OKP, assortment part, for products being manufactured by enterprises of the State Standards system permits solution with computer techniques of problems in planning, accounting, supply and equipment, and in other cases.

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CONCERNING EXPERIENCE IN THE REGISTRATION OF TECHNICAL AND ECONOMIC INFORMATION  
CLASSIFIERS (A DISCUSSION)

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 2, Feb 86 pp 24-27

[Article by N. L. Ivanova, L. N. Korneyeva, G. A. Prudnikov, and Ye. L. Sonechkina, candidate of historical sciences, Main Scientific Research Center for Management of All-Union Classifiers, under the general heading "Development and Introduction of Classifiers and the United System of Documentation."]

[Text] The registration of classifiers and document forms is accomplished with the purposes of providing for the effective functioning of automated management/control systems, their interaction, the inter-linking of classifiers of technical and economic information of various categories (all-union, industry-wide, republic, and classifiers of enterprises), and also the coupling of classifiers with unified forms of documents and the creation of a single unified support for automated management/control systems (ASU's).

The registration of classifiers helps improvement in their accounting and systematization on a country-wide scale, elimination of duplication in development, unification, improvement in quality, and provision for the broad utilization of classifiers of various categories.

Expert scientific and technical examination, accomplished during the process of registering classifiers, has been introduced for the solution of these problems.

Registration of classifiers are subdivided into state (All-Union Classifiers for Technical and Economic Information -- OK-TEI), industry-wide, agency (for classifiers of industries, agencies, and enterprises), and republic (for republic classifiers). State registration is conducted by the Main Scientific Research Center for the Management of All-Union Classifiers, and industry, agency, and republic registration, by the head organizations for OK TEI of ministries (agencies) and of union republics.

Experience in the registration of classifiers is generalized in this work on the basis of information acquired by the Main Scientific Research Center for the Management of All-Union Classifiers (GNITsVOK), examines practical questions of registration being done by head organizations for OK TEI, and notes the more typical errors committed during expert scientific and technical examination preceding the classifier registration itself.

On the basis of materials acquired by GNITsVOK, information was selected and reported to head organizations for OK TEI on over 900 classifiers of various categories, including 168 all-union classifiers, and it included the assortment parts of the All-Union Classifiers of Industrial and Agricultural Products to which individual registration numbers were given; 336 industrial and agency classifiers; 389 classifiers of enterprises; and 51 republic classifiers. Thus, quantitatively, the industrial (agency) classifiers predominate.

The analysis of classifier registration materials indicates the necessity for improving the quality of their expert scientific-technical examination.

During such examinations, attention should be given to the following questions: the correspondence of the classifiers to the requirements of a rational selection of classifier capacity, depth of classifier, and code length; the appropriateness of developing and using industrial (agency) and republic classifiers and classifiers of enterprises; the unification of classifiers that are uniform or similar in composition to the subjects included and designated for automated management/control systems of various levels (automated management system for an industry, automated management system for an association, and automated enterprise management system).

The analysis of information on classifiers registered during 1983-1984 has shown that the most widespread shortcomings are the following:

- the registration by a head organization of a number of classifiers of the same category that include similar subjects or of classifiers with small capacity that unite information close in content and purpose, with the allocation of an individual classification number to each classifier;

- the registration of industry and agency classifiers and classifiers of enterprises when there are appropriate existing OK TEI;

- the registration of classifiers in which non-rational use is made of the capacity, or the titles do not reveal the content; and

- the nonobservance of requirements for the formation of information being sent to GNITsVOK.

The most characteristic errors committed in this work are introduced below.

Head organizations of ministries (agencies) sometimes register several enterprise classifiers containing information of similarly constituted subjects. Thus, the requirement for unification of similar classifiers within the boundaries of an industry are not observed. For example, during one year, a head organization of a ministry registered the similarly named classifiers of enterprises under various numbers: "Quarterly Periods," "Calculation Cost Items," "Reasons for Nonfulfillment of Plan," "Time Periods," "Months," "Dates," and "Calendar Periods."

Cases have been noted of the registration of industry classifiers for individual types of technical and economic information for which the appropriate all-union classifiers already have been developed and introduced. For example, a number of ministries have developed, have registered, and are using

industry-wide classifiers and enterprise classifiers that include lists of workers' vocations, service positions and pay scales, measurement units, and personnel information. Some of these classifiers contain data that are incomplete in comparison with the OK TEI.

Head organizations of ministries (agencies) and of union republics, having made decisions on the usefulness of registering classifiers of industries (agencies), of republics, and of enterprises, should take into consideration the availability of corresponding all-union classifiers.

Important principles in the development of classifiers are the provision for their sufficient capacity and economically justified depth of classification and also minimal code length. These requirements are not always observed for industry classifiers and enterprise classifiers. Thus, at present, a registered enterprise classifier (of a production association), "Structural Subdivisions," is operating with 160 positions with the code length of 9 symbols.

In a number of cases, registered classifiers have names which do not reflect the contents of the information covered and sometimes do not respond to the rules of the Russian language (for example, titles such as "Types of Day of the Week," "Positions of Ministry Persons," and "Abbreviation of Titles of Rolling-Stock Units and Assemblies").

Instead of developing and registering (as industrial) certain classifiers with a small quantity of positions for technical and economic information, in a number of instances it is economically more effective to develop a single classifier in facet form.

Thus, instead of the independent classifiers "Flags for Contents by Control Sheet," "Flags for Contents of Fees" (each with position quantity "2" and word length code "1"), one classifier should be developed under the general title "Flags for Contents."

Improvement in the quality of expert scientific and technical examination in connection with the registration of classifiers will create an additional barrier to unjustified application of industry, agency, and republic classifiers and classifiers of enterprises and, at the same time, will help to expand the sphere of utilization of all-union classifiers.

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# A CONTROL SYSTEM FOR A NC MACHINE TOOL ON THE BASIS OF THE ELEKTRONIKA-60M MICROCOMPUTER

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA in Russian No 1, Jan 86 pp 41-42

[Article by P. N. Pechatkin and V. Ye. Khodakov]

[Text] Automatic control systems for metal-working lathes make extensive use of microprocessor technology. There are two basic trends in the development of numerical control (UCHPU) equipment built from microprocessors: universal [1] and specialized [2,3] systems.

We describe below a specialized system for control of a type N33-2M three-coordinate NC milling machine. It differs from the familiar unit [1] in being more narrowly specialized and using the language ASSEMBLER and the microcomputer Elektronika-60M. Consequently, it is faster in operation and lower in cost. The NC control is exercised directly by the microcomputer, bypassing the optical reader, which, in the first place, greatly enhances the universality of the system, since the permanent memory (ROM) of the microcomputer can store a complex of programs for the working of metal articles and, moreover, universal programs can be written for the fabrication of parts of the same configuration, differing only in size; secondly, the operator is freed from the need to employ punched tape, which greatly enhances the reliability of the machine control system.

Development of a microcomputer NC control system encounters the problem of designing the interfaces, i.e., selection of an interface device and development of an interface software. Since the microcomputer Elektronika-60M has a whole series of standard interfaces for peripherals, the present system employs the standard interface 15KS-180-032.

A diagram of the interface between the microcomputer and the machine is shown in Fig. 1.

In accordance with this diagram, the microcomputer analyzes the readiness of the NC to receive data. On the "Ready" signal, corresponding to the "Start" position of the "Start/Stop" flip flop in the optical reader control circuit, the microcomputer sends the next frame across the interface I2 to the NC input register. After receiving the frame, on the signal "Stop" the sending of information from the microcomputer ceases. The microcomputer receives author-

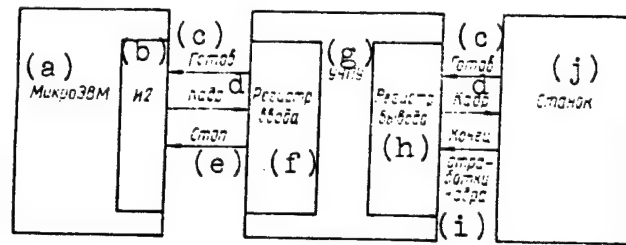


Fig. 1. Diagram of the interface between a microcomputer and a machine tool.

Key:

- |                  |                               |
|------------------|-------------------------------|
| a. Microcomputer | f. Input register             |
| b. I2            | g. NC equipment               |
| c. Ready         | h. Output register            |
| d. Frame         | i. End of processing of frame |
| e. Stop          | j. Machine tool               |

ization to send the next frame upon completion of the processing of the previous frame by the actuating mechanisms of the machine tool.

The indicated operational sequence of the control system is implemented by software. The driver sends control information by frames from the microcomputer to the NC equipment, stopping the transmission at the end of each frame. A diagram of the driver is shown in Fig. 2.

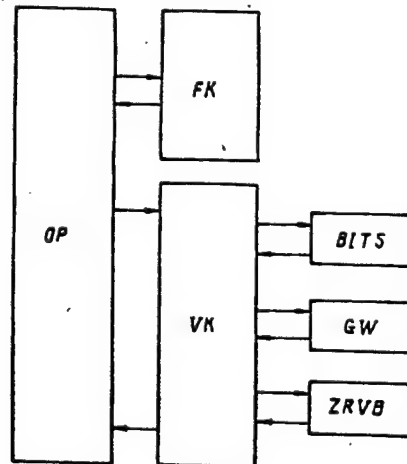


Fig. 2. Diagram of the driver.

The operation of the driver begins with the main program OP calling up the subprogram for formation of control signals FK. The subprogram FK calculates

the values of the control signals, sends them to the buffer of the micro-computer and transfers control to the main program. Then, the main program calls up the subprogram for output of the frame VK and transfers control to it. In turn, the frame output subprogram calls up successively the subprograms for formation of the parity check bit BITS, check-out of NC readiness for information input GW, and formation of a signal delay of necessary length by the internal lines ZRVB.

The subprogram BITS analyzes the parity of each information byte being put out and, if necessary, forms a parity check bit and adds it to the corresponding byte. Thus, BITS recodes the information from the KOI-7 codes of the micro-computer into the ISO codes used by the NC.

After input of the next frame, the subprogram VK transfers control to the OP. The main program again accesses FK and the cycle repeats. The condition of escape from the cycle is formed in the subprogram FK.

Testing of the above control system of the NC machine tool N33-2M conducted at the Kherson Production Association "Combine Factory imeni G.I. Petrovskiy" has demonstrated its serviceability and adequate reliability.

At present, the system is being adopted in the opticomemical production of the Crimean Astrophysical Observatory of the USSR Academy of Sciences. Its purpose is to control the machine fabricating the mirrors of large telescopes.

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## SUPPLY OF CORRECT DATA TO AUTOMATED CONTROL SYSTEMS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 5, Sep-Oct 85  
(manuscript received after revision 19 Mar 85) pp 13-15

[Article by G.V. Druzhinin]

[Abstract] The reduction of errors in data required by automated control systems due to staff psychosocial factors is considered. The errors are introduced by staff who either did not understand questions or for some reason gave incorrect information. One solution is to eliminate human intervention and completely automate procedures but this is not always possible. Careful selection of personnel acting as data sources according to political and professional criteria is possible and attempts have been made to formalize criteria for staff selection. Methods are considered for improving the reliability of work within the work group by means of the data correctness monitoring system (SKID) whose effectiveness can be determined on the basis of data error frequency evaluations. SKID monitoring can be followed either by direct feedback to the data source who is a member of the group or by feedback to the group administration which then corrects and disciplines the data source. When the error probability is high good results are possible with relatively light punishments while when error probability is low even strict punishments which are not certain will not improve results. Data source work when supervised by SKID should be limited to specific indicators, data check periods must be short enough not to interfere with the process and various check procedures should be applied randomly. It is necessary to collect data from different sources and from previous experience with the observed procedures in order to establish criteria for data sources. The correctness of data source results can also be evaluated by means of correlation SKID based on probability relations between the observed indicators so as to evaluate result trends. Test SKID use questionnaires containing trick questions to evaluate the capacities of data sources and possible subjective distortions.

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## SYSTEMATIZATION OF INITIAL INFORMATION MODELS FOR AUTOMATED DESIGN OF ASSEMBLY ELEMENTS AND PARTS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 5, Sep-Oct 85  
(manuscript received after revision 14 Dec 84) pp 9-13

[Article by V.P. Bychenko]

[Abstract] The principles of the MIREA-VEKTOR computer-aided design system (CAD) developed at the Moscow Institute of Radiotechnology, Electronics and Automation are described. CAD involves transforms of stored initial information models based on standard designs and previously developed solutions. The stored data must be available to the designer in the form of graphic representations. Principles are presented for systematizing the initial information models for CAD procedures and allowing unification of CAD language and programming. The initial models can be of two hierarchical types, either situational referring to design data covering all design problems or elementary referring to particular structural elements and stored reference data and standards. There are three levels of increasing complexity for each hierarchical type. Transformations of the models in dialogue mode on the videoterminals are executed by means of the basic procedures of exclusion, inclusion of additional material or assembly of material from various initial models depending upon the required characteristics. The use of initial information models requires a standard method for the breakdown of designs into functional structural components consisting of parts, elements and primitives which are represented either mathematically in digital models in the memory or graphically as shapes on the screen. There is a procedure for forming graphic models allowing the creation of problem-oriented data bases which can be further improved by operational experience. The CAD is realized on an automated work site and display with a PFMI-20 device for storage on microfiches which is manipulated in dialogue mode. References: 7 Russian.

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## SYSTEM DESIGN FOR AUTOMATED SCIENTIFIC RESEARCH CONTROL SYSTEM

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 5, Sep-Oct 85  
(manuscript received after revision 12 May 84) pp 92-95

[Article by V.G. Grishko]

[Abstract] The problem is considered of the selection of optimal systems of automated scientific research control systems (ASNI) on the basis of



quality criteria, allowing identification of certain variants of the optimal system. The extremal quality criteria can be mutually contradictory and a solution method for formulating the optimum is described involving the determination of a criterion space. Information criteria are evaluated according to system space entropy while parametric criteria are considered to be information losses and operational characteristics. Complexity is used as the structural criterion and is evaluated according to the quantity of topological information incorporated in graph models. The economic effectiveness of the system is evaluated by the required expenditure. The results are then scaled but since there is no objectively correct evaluation formalization is not possible and a heuristic procedure is necessary. An optimal variant is then selected. A system design program package in FORTRAN was developed at the Strength Problems Institute of the UkSSR Academy of Sciences whose structure consists of a resident section and seven overlay blocks operating in dialogue mode for realization on an SM-4 computer. An example is given of the computation of an ASNI fragment concerning the establishment of optimum complexity for automated regulation and data processing systems showing projection in criterion space. Figures 1; references 4: 3 Russian, 1 Western.

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CSO: 1863/64

RELIABILITY AND EFFECTIVENESS OF LINK SESSION WITH CONTROLLED INTERRUPT AND  
LINK REGENERATION BY INTELLIGENT TERMINAL FACILITIES

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 6, Nov-Dec 85  
(manuscript received 20 Aug 84) pp 10-16

[Article by V.F. Tsvetkov]

[Abstract] The automated subscriber network of the All-Union Scientific and Technical Information Center can have different types of subscriber point terminal equipment. Network efficiency in channel switching mode is improved by the use of the YeS 8534 intelligent terminal operating on the PD-200 network using the simplest synchronous AP-70 protocol. Use of the intelligent terminal increases the number of functions performed by the system by means of redistribution of them from the host computer. During the link session with improved efficiency much system channel time is unused and the described design involves interleaving of operations carried on by various terminals connected to the host computer. This involves interrupting the link to the terminal and the problem was to improve effectiveness of the interrupt-restoration operations and avoid information losses following an interrupt. A documentation search algorithm with additional interrupt and restore procedures for the improved system is given. Improved line switching control is necessary and the TTX-300 telegraph signal converter unit operating through the intelligent terminal was developed which automatically sets up the required subscriber link giving the operator the impression of an unbroken connection to the computer. Comparison of the time characteristics of the previous and improved link methods shows that while in the first case the terminal is on-line for an entire session of 24 minutes the channel is only occupied 23 percent, in the second case the subscriber is actually on-line 9 out of 24 minutes and channel occupancy is 88 percent. The automated link procedures make system efficiency much less dependent upon the skill and preparation of the interacting subscriber. The system cannot at the present time be adapted for existing telephone lines because of the absence of modems and the extremely low and unreliable speed of the process of establishing intercity lines.

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CSO: 1863/138

## ARCHITECTURE OF LOCAL NETWORK FOR HIGH-PERFORMANCE COMPUTER SYSTEMS

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 6, Nov-Dec 85  
(manuscript received after revision 30 Oct 84) pp 35-41

[Article by V.A. Melnikov and Yu.N. Znamenskiy]

[Abstract] Since the semiconductor components of computer systems are reaching their response speed limits to within an order of magnitude, the way to improve productivity for large computers is now the formation of heterogeneous multicomputer problem-oriented local computer networks which can produce improvements as to archive management, program translation, task preparation, vector and matrix computation, graphic data handling and network service. The linked large computers have a certain degree of independence and must have their own operating systems and main storage while failures of individual units only partially degrade system operations. Up to 20 stations are now being linked in trunk-topology networks with sequential data transmission. Special link protocols are required which can execute the required monitoring and restoration procedures. In spite of the rising levels of integration the physical dimensions of the large computers in the local networks have remained the same because of increasing speed requirements and increasing task complexity. The local systems which differ from average speed systems using mini- and microcomputers are therefore necessary. Specialized computers have their own programming making interfacing difficult and the local network must have its own equipment for organizing interaction which also allows the introduction of new types of computers. Two U.S. systems are described as examples: Hyperchannel of the Network System Corp. linking very powerful computers (Cray-1, PDP-11) and CDC's Loosely Coupled Network in particular the Cyber-200 system linked to the large Cyber-205 computer with possible linkage of PDP-11 and IBM-370 computers. The international standard ISO 7498 and CCITT X.200 recommendation fix the general principles for network architecture with specifics of transmission medium, protocols and services determined by the particular case. In the network there are relatively few large computers handling massive data flows, control and interface computers and specialized adapters for network access and service functions. System transmission is now by radio frequency coaxial cable with decentralized control with speeds of 20-50 Mbytes/s. Optical fiber has not yet been introduced because reliable converters are not available. The determining parameter in comparing access throughput methods is the length of the data frame which is now of the order of 1-4 KByte. Efforts are being made to transfer the maximum number of protocol functions from the component computers to the network adapters which can now handle up to the 4th or 5th protocol level of the ISO standard model. Figures 4; references: 10 Russian, 2 Western.

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## CONCEPT OF DESIGN OF MULTIFUNCTIONAL INTEGRATED NETWORK SERVICE

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 6, Nov-Dec 85  
(manuscript received 12 Apr 85) pp 48-53

[Article by E.V. Zinovyev]

[Abstract] The concept is considered of a multifunctional integrated network service (MIS) nucleus consisting of a nonredundant and complete base set of components constituting an automated system formed of a base processor with base function words whose state changes trigger a set of functional processors. This reflects a network system conceived as a working computer nucleus and a set of terminal computers. Standardization of protocols is now continuing but has not yet affected application levels and the development of MIS would allow the user access to integrated sets of services requiring only a single agent in the terminal computer and would greatly simplify network exploitation by the user. The presented MIS concept has external and internal invariance which means that the MIS nucleus is not directly dependent upon resources and procedures used in the external or internal mediums. A formalization of the MIS nucleus automaton is given but realization problems, some of which concern the incorporation of the nucleus in the telecontrol monitor system, are not discussed. Figures 4; references: 4 Russian, 2 Western.

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